

### **REMARKS**

Applicants have carefully reviewed and considered the Office Action mailed on May 6, 2003.

Claims 18, 37, and 43 are amended. No claims are canceled or added. As a result, claims 18-25, 27-28, 30-43, and 45-47 remain pending in this application.

### **Information Disclosure Statement Previously Submitted on November 25, 2002**

Applicants filed an Information Disclosure Statement with the U. S. Patent Office on February 21, 2001. To date, Applicants have not received the Form 1449 filed therewith and marked as being considered by the Examiner. Pursuant to the provisions of MPEP 609, Applicants request that a copy of the Form 1449, initialed as being considered by the Examiner, be returned to the Applicants with the next official communication.

### **Amendments to Claims 18, 37, and 43**

Each of independent claims 18, 37, and 43 has been amended by substituting "a circular perimeter" for "a substantially circular perimeter". No new matter has been introduced. Support for these amendments may be found, for example, in FIG. 5 of Applicants' drawings, in which lands 130 and 131 are depicted as circular.

### **Rejection of Claims 37, 38, 43 and 45-47 under 35 U.S.C. §102(b) as Anticipated by Sherman**

Claims 37, 38, 43 and 45-47 were rejected under 35 U.S.C. §102(b) as being anticipated by Sherman (U.S. 5,784,262).

Sherman discloses an arrangement of pad-through-hole combinations (21A, FIG. 2A) on a substrate. Each pad-through-hole combination includes a mounting pad 18A connected to a via pad 26A through a narrow neck-like structure or trace 27A. FIG. 3 shows an arrangement of pad-through-hole combinations, in which groups of pad-through-hole combinations are oriented in different directions. In Sherman, the pad-through-hole combination has a dumb-bell shape.

By contrast, independent claims 37 and 43, as amended, recite *inter alia* that each land has a circular perimeter. The structure recited in independent claims 37 and 43 is different from that disclosed in Sherman and provides a potentially more dense arrangement of lands.

For the above reasons, independent claims 37 and 43 should be found to be allowable over Sherman, and Applicants respectfully request that the rejection of claims 37 and 43 under 35 U.S.C. §102(b) as anticipated by Sherman be withdrawn.

Claims 38 and 46, which depend from independent claim 37, and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

Claims 45 and 47, which depend from independent claim 43, and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

**Rejection of Claims 18-20 and 34-36 Under 35 U.S.C. §103(a)**  
**as Unpatentable over Sherman in View of Perfecto**

**Claims 18-20**

Claims 18-20 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sherman in view of Perfecto et al. (U.S. 5,464,682).

Sherman was discussed above.

Perfecto discloses a ceramic substrate (20, FIG. 2) having a circular pad 30. The pad 30 connects a ceramic via 22 with a thin film stud contact portion 28. Perfecto apparently contains no disclosure concerning how a chip (16, FIG. 1) is connected to a substrate 20. Further, Perfecto apparently contains no disclosure as to a solder ball adhering to a respective one of the pads 30.

Regarding independent claim 18, the Examiner stated that it would have been obvious to one of ordinary skill in the art to combine the teachings of Sherman and Perfecto in order to have the Sherman land with the same shape as the Perfecto land, in such a way that each solder ball can adhere to the entire land.

Independent claim 18, as amended, is directed to structure that is not disclosed in either Sherman or Perfecto, so a *prima facie* case of obviousness has not been established. For example, claim 18 recites *inter alia* a plurality of lands each having a circular perimeter, and a

plurality of solder balls, each solder ball adhering to a respective one of the lands, each solder ball adhering to the entire respective land.

For the above reasons, claim 18 should be found to be allowable over any combination of Sherman or Perfecto, and Applicant respectfully requests that the rejection of claim 18 under 35 U.S.C. § 103(a) as being unpatentable over Sherman in view of Perfecto should be withdrawn.

Claims 19-20, which depend directly or indirectly from claim 18 and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

### Claims 34-36

Claims 34-36 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sherman in view of Perfecto et al. (U.S. 5,464,682).

Independent claim 34 recites *inter alia* a substrate comprising a plurality of solder balls, each solder ball adhering to a respective one of the lands, each solder ball adhering to the entire respective land without any material intervening between the solder ball and the respective land.

Regarding independent claim 34, the Examiner stated that it would have been obvious to one of ordinary skill in the art to combine the teachings of Sherman and Perfecto in order to have the Sherman land with the same shape as the Perfecto land, in such a way that each solder ball can adhere to the entire land.

Sherman and Perfecto were discussed above.

Applicants respectfully assert that a *prima facie* case of obviousness has not been established, and that the suggested combination of Sherman and Perfecto is based upon hindsight and would not have been suggested but for Applicants' own disclosure.

To establish a *prima facie* case of obviousness, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine them to arrive at Applicants' claimed subject matter. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. MPEP § 2143.

Applicants respectfully assert there is no suggestion or motivation in either Sherman or Perfecto, whether considered individually or collectively, for combining these two references to arrive at the subject matter claimed in claim 34. As pointed out earlier, Sherman does not appear

to contain any disclosure concerning circular pads nor any suggestion of substituting a circular pad for the dumbbell-shaped pads disclosed in Sherman.

Nor does Perfecto appear to contain any disclosure regarding a solder ball adhering to any circular pad 30, let alone to an entire pad 30. In Perfecto, pads 30 (FIG. 2) are described as being used to connect a ceramic via 22 with a thin film stud 24 (FIG. 2, described in col. 2, lines 52-57) and not for the purpose of mounting corresponding IC contacts, so there is no suggestion or motivation in Perfecto to provide solder on pads 30, or to substitute pads 30 for the dumbbell-shaped pads 21A (FIG. 2A) of Sherman. Further, the pads 30 of Perfecto actually teach away from the subject matter claimed by Applicants, for example, in independent claim 34, because in Perfecto the “large capture pad” 30 (FIG. 2) must be sufficiently wide to make physical and electrical contact with both the ceramic via 22 and the thin film stud 24, which width may vary depending upon manufacturing tolerances. In contrast, in Applicants’ subject matter the pad may comprise only a single via, so pad density may be potentially greater.

In his “Response to Arguments”, the Examiner asserts that “the Perfecto reference is used to teach an offset circular land 30 that connects a via to another circuit layer, in order to modify the Sherman invention”. However, as mentioned above, Applicants respectfully assert that neither Sherman nor Perfecto contains any suggestion or motivation for modifying the Sherman invention as the Examiner has proposed.

Thus, Applicants respectfully assert that a *prima facie* case of obviousness has not been established. First, the Examiner has not provided any suggestion or motivation in the references themselves. Secondly, the Examiner has not provided any credible suggestion or motivation in the knowledge generally available to one of ordinary skill in the art, to combine the Sherman and Perfecto references to arrive at Applicants’ claimed subject matter.

Regarding the issue of when it is reasonable to combine references to establish obviousness, the Examiner is referred to *In Re Sang Su-Lee*, Serial No. 07/631,240, CAFC, 00-1158, January 18, 2002 (copy attached).

On page 7, beginning line 19, the CAFC stated:

“ ‘The factual inquiry whether to combine references must be thorough and searching.’ Id. It must be based on objective evidence of record.”

On page 9, beginning line 1, the CAFC stated:

“ . . . the examiner can satisfy the burden of showing obviousness of the combination ‘only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references’ ”.

In the present case, Applicants respectfully assert that the Examiner has not produced any convincing objective evidence or objective teaching to support his position that it would have been obvious to combine the teaching of Sherman and Perfecto. Applicants assert that the Examiner’s suggested combination of Sherman and Perfecto is based solely upon hindsight and would not have been suggested but for Applicants’ own disclosure.

For the above reasons, independent claim 34 should be found to be allowable over any combination of Sherman or Perfecto, and Applicants respectfully request that the rejection of claim 34 under 35 U.S.C. §103(a) as being unpatentable over Sherman in view of Perfecto should be withdrawn.

Claims 35-36, which depend from claim 34 and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

**Rejection of Claims 21, 25, 27-28, and 30 Under 35 U.S.C. §103(a)**  
**as Unpatentable over Sherman in View of Perfecto**

Claims 21, 25, 27-28 and 30 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sherman in view of Perfecto et al.

Regarding independent claims 21 and 28, the Examiner stated that it would have been obvious to one of ordinary skill in the art to combine the teachings of Sherman and Perfecto in order to have the Sherman land with the same shape as the Perfecto land, in such a way that the solder balls are contacting substantially the entire respective land and to the edge of such land.

Sherman and Perfecto were discussed above.

As set forth above, Applicants assert that a *prima facie* case of obviousness has not been established, because any suggestion or motivation, either in the Sherman and Perfecto references themselves or in the knowledge generally available to one of ordinary skill in the art, is lacking to combine them to arrive at the subject matter recited in independent claims 21 and 28.

For the above reasons, independent claims 21 and 28 should be found to be allowable over any combination of Sherman or Perfecto, and Applicants respectfully request that the rejection of claims 21 and 28 under 35 U.S.C. §103(a) as being unpatentable over Sherman in view of Perfecto should be withdrawn.

Claims 25 and 27, which depend from independent claim 21, and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

Claim 30, which depends from independent claim 28, and incorporates all of the limitations therein, is also asserted to be allowable for the reasons presented above.

**Rejection of Claims 22-24 Under 35 U.S.C. §103(a)**  
**as Unpatentable over Sherman in View of Perfecto**  
**and Further in View of Mehr**

Claims 22-24 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sherman in view of Perfecto et al. and further in view of Mehr (U.S. 5,936,848).

The Examiner stated that it would have been obvious to one of ordinary skill in the art to further modify the combination of Sherman and Perfecto with Mehr, in order to have a thermally expansive substance (i.e. solder mask material 38) residing in the vias.

Sherman and Perfecto were discussed earlier. Mehr discloses an electronics package that includes a substrate, a via, and a solder ball. As seen in FIG. 3 of the Mehr patent, solder mask material 38 partially enters into the via 32.

Claims 22-24 are dependent, directly or indirectly, from independent claim 21, which Applicants assert is patentable over the Examiner's suggested combination of Sherman and Perfecto, as set forth earlier. The addition of Mehr to the Examiner's suggestion combination of Sherman and Perfecto would not substantively impact the patentability of independent claim 21.

Thus, claims 22-24, which depend directly or indirectly from claim 21, and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

Applicants respectfully request that the rejection of claims 22-24 under 35 U.S.C. §103(a) as unpatentable over Sherman in view of Perfecto and further in view of Mehr be withdrawn.

**Rejection of Claims 31-33 Under 35 U.S.C.§103(a)**  
**as Unpatentable over Sherman in View of Perfecto**  
**and Further in View of Sakemi**

Claims 31-33 were rejected under 35 U.S.C.§103(a) as being unpatentable over Sherman in view of Perfecto et al. and further in view of Sakemi et al (U.S. 5,489,750).

The Examiner stated that it would have been obvious to one of ordinary skill in the art to further modify the combination of Sherman and Perfecto with Sakemi, in order to have each solder ball covering the entire respective land, including the perimeter of the land.

Sherman and Perfecto were discussed earlier. Sakemi discloses a method of mounting an electronic part with bumps on a circuit board (FIG. 8, described in col. 4, line 66 through col. 5, line 3).

Claims 31-33 are dependent from independent claim 18, which Applicants assert to be patentable over the Examiner's suggested combination of Sherman and Perfecto, as set forth earlier. The addition of Sakemi to the Examiner's suggestion combination of Sherman and Perfecto would not substantively impact the patentability of independent claim 18.

Thus, claims 31-33, which depend from claim 18, and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

Applicants respectfully request that the rejection of claims 31-33 under 35 U.S.C.§103(a) as unpatentable over Sherman in view of Perfecto and further in view of Sakemi be withdrawn.

**Rejection of Claims 39-41 Under 35 U.S.C.§103(a)**  
**as Unpatentable over Sherman in View of Mehr**

Claims 39-41 were rejected under 35 U.S.C.§103(a) as being unpatentable over Sherman in view of Mehr.

The Examiner stated that it would have been obvious to one of ordinary skill in the art to further modify the combination of Sherman and Perfecto [sic] with Mehr, in order to have a thermally expansive substance (i.e. solder mask material 38) residing in the vias. (Applicants believe the Examiner's mention of Perfecto in this rejection was unintentional.)

Sherman and Mehr were discussed above.

Claims 39-41 are dependent directly or indirectly from independent claim 37, which Applicants assert to be patentable over Sherman, as set forth earlier. The addition of Mehr to Sherman would not substantively impact the patentability of independent claim 37.

Thus, claims 39-41, which depend from claim 37, and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

Applicants respectfully request that the rejection of claims 39-41 under 35 U.S.C. §103(a) as unpatentable over Sherman in view of Mehr be withdrawn.

**Rejection of Claims 42-44 Under 35 U.S.C. §103(a)  
as Unpatentable over Sherman in View of Perfecto**

Claims 42 and 44 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sherman in view of Perfecto et al. Applicants note that claim 44 was cancelled in Applicants' previous response.

The Examiner stated that it would have been obvious to one of ordinary skill in the art to combine the teachings of Sherman and Perfecto to have a circular land.

Sherman and Perfecto were discussed above.

Claim 42 is dependent from independent claim 37, which Applicants assert to be patentable over Sherman, as set forth earlier.

Thus, claim 42, which depends from claim 37, and incorporates all of the limitations therein, is also asserted to be allowable for the reasons presented above.

Applicants respectfully request that the rejection of claim 42 under 35 U.S.C. §103(a) as unpatentable over Sherman in view of Perfecto be withdrawn.

**Additional Elements and Limitations**

Applicants consider additional elements and limitations of claims 18-25, 27-28, 30-43, and 45-47 to further distinguish over the cited references, and Applicants reserve the right to present arguments to this effect at a later date.



**Conclusion**

Applicants respectfully submit that claims 18-25, 27-28, 30-43, and 45-47 are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicants' attorney Walter W. Nielsen (in Phoenix, Arizona) at 602-298-8920 or the below-signed attorney (in Minneapolis, Minnesota) to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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Date July 7, 2003

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 7th day of July, 2003.

Name: KACIA LEE Signature: Kacia Lee